

V. REMARKS

Claims 1-5 and 16 are rejected under 35 U.S.C. 102(b) as anticipated by Kidd (U.S. Patent No: 4,925,542). The rejection is respectfully traversed.

Kidd discloses a plasma plating apparatus that includes a plasma generating device having a vacuum chamber, a microwave energy source, sputter plate, a substrate support plate, a metal screen and an aperture plate. The metal screen is positioned in front of the support plate and an aperture plate. A region is identified within the chamber which is referred to as an electron cyclotron resonance heating zone. The chamber is formed of stainless steel, aluminum or some other material which is non-magnetic and vacuum tight.

Claim 1, as amended, is directed to a plasma cleaning device that includes a chamber for cleaning a process target disposed therein with a plasma, a process gas introducing mechanism for introducing a process gas into a chamber, opposite electrodes of a pair of an active electrode and an earth plate electrode grounded which are housed in the chamber, a plasma generating power supply, a disposing position of a process target for disposing the process target outside a space between the opposite electrodes and an electrically conductive path connected to the process target.

First, Applicants would like to point out that the term "plate" now provided in claim 1 to further describe the shape of the earth electrode does not introduce new matter for two reasons:

1. A conventional plasma cleaning device in which an earth electrode in the shape of a lattice has been used and a process target has been disposed at the other side of the earth electrode from the active electrode is recited as a prior art in the present application (page 2, lines 2 - 5). It follows that the earth electrode in the present invention does not include such a lattice earth electrode.

2. The earth electrode 14 in Fig. 1 is shown as a plate shape.

Therefore, it is respectfully submitted that the incorporation of the shape of the earth electrode as "plate" is not new matter.

The present invention has following features for achieving a raised cleaning effect while suppressing the heating of the process target to a high temperature.

1) The disposing position of the process target is set outside a space between the opposite electrodes which comprise a pair of the active electrode and the plate earth electrode;

2) The active electrode is connected to the plasma generating power supply; and

3) The process target is connected to the electrically conductive path.

In the present invention, the plasma is generated between the opposite electrodes by the power supplied from the plasma generating power supply to the active electrode, and the cleaning function of the process target positioned outside the space between the opposite electrodes is carried out by the plasma, which is not accelerated by an accelerating mechanism such as a cyclotron as in the Kidd's device.

By disposing the process target not in the space between the opposite electrodes but outside the space, and by using a plate as the earth electrode, the process target has no chance to be exposed directly to the plasma generated in the space even though the process target is positioned just behind the earth electrode, with the result that the process target has no possibility to be heated to a high temperature.

Furthermore, by connecting the electrically conductive path to the process target, it is prevented from occurring that the process target is charged and ions in the plasma are easy to act on the process target, which increases a cleaning effect. With such a construction adopted, a sufficient cleaning effect can be achieved.

By contrast, the plasma device of Kidd, which is shown in its Fig. 1, belongs to a different type of plasma device from the present plasma device. Kidd's device provides a microwave energy source 3, sputter plate 5 and a metal screen 9 in the vacuum chamber 1. The microwave energy source 3 is a plasma

generating power supply. The ions in the plasma 14 generated by the microwave energy source 3 is accelerated by the cyclotron to be applied onto the substrate 23 which is positioned behind the metal screen 9 through the metal screen 9 to clean the substrate 23. The energy of ions applied onto the substrate 23 is selected by adjusting the voltages of the dc voltage 15 connected to the sputter plate 5 and the dc voltage 19 connected to the support plate 7 supporting the substrate 23.

From the above description of Kidd's device, it is respectfully submitted that the Examiner's assertions of "an active electrode 5" and "a plasma generating power supply 15 connected to the active electrode" are improper.

It follows that the substrate 23 is exposed directly to the plasma come through the metal screen 9 resulting in heating the substrate 23 to a high temperature. Thus, Kidd's device cannot achieve the effect of the present invention of suppressing heating the substrate 23 to a high temperature.

Therefore, it is respectfully submitted that Kidd does not teach nor suggest the present invention including the above identified features 1) to 3).

Claims 2-5 and 16 depend from claim 1 and include all of the features of claim 1. Thus, it is respectfully submitted that that the dependent claims are allowable at least for the reason claim 1 is allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of Li et al. (U.S. Patent No: 6,178,919). The rejection is respectfully traversed.

Li teaches a plasma processing reactor for processing a substrate that includes a chamber, a top electrode, a bottom electrode, an insulating shroud and a perforated plasma confinement ring. The top electrode is configured to be coupled to a first RF power source having a first RF frequency. The bottom electrode is configured to be coupled to a second RF power source having a second RF frequency that is lower than the first RF frequency. The insulating

shroud lines an interior of the chamber and is configured to be electrically floating during the processing. The perforated plasma confinement ring surrounds and is disposed outside of an outer periphery of the bottom electrode. Also, the perforated plasma confinement ring is disposed in its entirety at or below a top surface of the substrate. Further, the perforated plasma confinement ring is formed from an electrically conductive material and is electrically grounded during the processing so as to increase ion energy during the processing by removing electrons from the plasma.

Claims 6 and 13 depend from claim 1 and include all of the features of claim 1. Thus, it is respectfully submitted that the dependent claims are allowable at least for the reason claim 1 is allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

Claims 7-9 are rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of Kidd in view of Godyak (U.S. Patent No: 4,792,727). The rejection is respectfully traversed.

Godyak reveals a system for controlling a gas discharge lamp to provide a positive voltage-current characteristic to permit stable lamp operation without a ballast. The system includes a device coupled to the lamp and defining a first source of power to provide electron heating without in itself providing ionization of the lamp gas and a device also coupled to the lamp and defining a second pulsed source of power having an average output power substantially less than the first source output power to provide ionization of the lamp gas and having a duty cycle substantially less than unity.

Claims 7-9 depend from claim 1 and include all of the features of claim 1. Thus, it is respectfully submitted that the dependent claims are allowable at least for the reason claim 1 is allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

Claims 10-12 are rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of the English abstract and Figures of Ito et al. (Japanese

Unexamined Patent Publication 62-267483). The rejection is respectfully traversed.

JP 483 discloses a plasma treating chamber in which a processing gas is introduced. Electric power is applied on an upper electrode by a high-frequency power source and is conducted to a grounded substrate electrode and a capacitor to generate plasma between the electrodes. The ions formed in the plasma is injected onto the substrate that is placed on the substrate electrode through an insulator sheet to carry out etching.

Claims 10-12 depend from claim 1 and include all of the features of claim 1. Thus, it is respectfully submitted that the dependent claims are allowable at least for the reason claim 1 is allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

Claim 14 is rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of Reavill (U.S. Patent No: 4,282,077). The rejection is respectfully traversed.

Reavill discloses a uniform plasma etching system that includes a chamber, a source of reactive gas for supplying to the chamber, an RF generator coupled to the chamber for generating a plasma therein and a plurality of part cells. The plurality of part cells is disposed within the chamber and formed by pairs of generally opposed electrodes of the same polarity. Plasma cells are located at each side of the part cells with each of the part cells being separated from each adjacent part cell by a plasma cell. Each of the plasma cells is defined by adjacent generally opposed electrodes of opposite polarity positioned to generate plasma externally of the adjacent part cell.

Claim 14 depends from claim 1 and includes all of the features of claim 1. Thus, it is respectfully submitted that claim 14 is allowable at least for the reason claim 1 is allowable as well as for the features it recites.

Withdrawal of the rejection is respectfully requested.

Claim 15 is rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of Reavill as applied to claim 14 and further in view of Japanese Patent 2574852. The rejection is respectfully traversed.

JP 852 discloses a discharge washer that includes a vacuum vessel, a vacuum evacuator, a plasma gas introducing unit, discharge electrodes placed in the vacuum vessel, a single power source that applies voltage upon the discharge electrodes oriented in parallel and variable resistors with each resistor provided in a circuit between the power source in each of the electrodes.

Claims 14 and 15 depend from claim 1 and include all of the features of claim 1. Thus, it is respectfully submitted that the dependent claims are allowable at least for the reason claim 1 is allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

Claim 17 is rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of Arai et al. (U.S. Patent No: 5,203,958). The rejection is respectfully traversed.

Arai teaches a processing apparatus that includes a first electrode, a second electrode, a plasma generating device, an introducing device, a pressure measuring device and a controller. The first electrode constitutes a susceptor for holding an object to be processed thereon. The second electrode is arranged to oppose the first electrode. The plasma generating device generates a plasma between the first and second electrodes and processing the object to be processed by the plasma. The introducing device automatically introduces a heat transfer medium gas into a gap between the object to be processed and the first electrode. The pressure measuring device measures a pressure of the heat transfer medium gas in the gap. The controller automatically controls further introduction of the heat transfer medium gas into the gap depending on the measured pressure of the heat transfer medium gas so that the pressure of the heat transfer medium gas reaches a predetermined value. An inorganic insulating film is formed on the first electrode and an elastic insulating film is formed on the inorganic insulating film.

Claim 17 depends from claim 1 and includes all of the features of claim 1. Thus, it is respectfully submitted that the dependent claim is allowable at least for the reason claim 1 is allowable as well as for the features it recites.

Withdrawal of the rejection is respectfully requested.

Claim 18 is rejected under 35 U.S.C. 103(a) as unpatentable over Kidd in view of Obinata (U.S. Patent No: 4,624,767). The rejection is respectfully traversed.

Obinata teaches a sputter etching apparatus that includes an evacuable vacuum treatment chamber, a sputter etching electrode mounted in the chamber for supporting a substrate to be etched, a device for evacuating the chamber, a device for introducing an etching gas into the evacuated chamber, a device for supplying electric power to the electrode for generating a plasma from the etching gas in the chamber, an opposite electrode and a magnet device. The opposite electrode is mounted in the chamber in an electrically floating condition facing the sputter etching electrode for confining the plasma in the space formed between the opposite electrode and the sputter etching electrode. Also, the opposite electrode is electrically insulated from contact with the chamber and from direct connection with the device for supplying electric power. The magnet device is mounted in the chamber for generating a magnetic field which extends substantially perpendicularly to the opposite electrode and the sputter etching electrode and extends in an axial direction along a peripheral open region surrounding the space so that the plasma is confined in the space.

Claim 18 depends from claim 1 and includes all of the features of claim 1. Thus, it is respectfully submitted that the dependent claim is allowable at least for the reason claim 1 is allowable as well as for the features it recites.

Withdrawal of the rejection is respectfully requested.

In view of the foregoing, reconsideration of the application and allowance of the pending claims are respectfully requested. Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' representative at the telephone number listed below.

Should additional fees be necessary in connection with the filing of this paper or if a Petition for Extension of Time is required for timely acceptance of the same, the Commissioner is hereby authorized to charge Deposit Account No. 18-0013 for any such fees and Applicant(s) hereby petition for such extension of time.

Respectfully submitted,

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Enclosure(s): Amendment Transmittal
 Petition for Extension of Time (1 month)

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